CORE
Metadata, citation and similar papers at core.ac.uk
Provided by Elsevier - Publisher Connector

11:45

POSTOPERATIVE FOLLOW-UP OF DISCRETE SUBAORTIC STENOSIS

David M. Coleman, Jeffrey F. Smallhorn, John Dyck, Norman Musewe, William G. Williams, Robert M. Freedom, The Hospital for Sick Children, Toronto, Canada.

The natural history of discrete subaortic stenosis (DSS) due to a fibromuscular ridge is one of almost universal progression of the subaortic obstruction and consequent damage to the aortic valve. Increasingly the subaortic ridge is being resected early in the course of this disease. We have attempted to determine the effect of surgery on the natural history of DSS.

Twenty-eight patients with DSS and no other significant cardiac abnormality were identified to have undergone open subaortic resection between May 1975 and January 1989. The preoperative, early and late postoperative catheterisation or echocardiographic findings as well as the operative reports were reviewed.

The mean age at operation was 7.0 ± 3.9 years. The preoperative LV outflow tract mean peak gradient (MPG) was 55 mm Hg (range 25-90). Fifteen pts had aortic insufficiency (AI) preoperatively, all of trivial or mild degree. At operation the aortic valve was normal in 23 pts. The 5 pts with abnormal aortic valves all had preoperative peak gradients of at least 50 mmHg. Postoperatively the entire group has been followed for a mean of 5.0 yrs (range 1.3-11). Two pts have required re-operation for recurrent DSS. One pt has undergone and another pt is awaiting aortic valve replacement. The preoperative MPG for these 4 pts was 64 mmHg (range 42-80). Excluding these 4 pts, the MPG at late follow-up is 15 mmHg (range 0-40). Seventeen pts have AI at late follow-up but only three of greater than a mild degree. Eight pts with preoperative peak gradients of ≤ 40 mmHg had normal aortic valves at surgery and at late follow-up a MPG of 10 mmHg (range 0-36) and AI of at most mild degree.

These results indicate that surgical treatment of DSS does improve the natural history of this disease and may suggest that subaortic resection at relatively low peak gradients is beneficial.

10:45

SIMULTANEOUS ASSESSMENT OF CORONARY FLOW RESERVE USING INTRACORONARY DOPPLER AND MYOCARDIAL CONTRAST ECHOCARDIOGRAPHY IN HUMANS.

Thomas R. Porter, Alwyn D'Sa, Carroll Turner, Anthony J. Minisi, Pramod Mohanty, Larry Pesko, George Vetrovec, J.V. Nixon, McGuire VAMC and Med. Coll. of Va., Richmond, VA

Although myocardial contrast echocardiography (MCE) has been used experimentally to assess coronary flow reserve (CFR), this technique has not been validated in humans. We simultaneously assessed CFR using MCE and measurements of coronary blood flow velocity obtained with a 3.5F Millar Doppler catheter placed in the left anterior descending artery. Left main (LM) papaverine injections (12 mg.) were used to elicit maximal hyperemic flow. MCE was performed by the transthoracic (n=5) or transesophageal (n=1) approach using 2.0 ml. bolus injections of 5% sonicated albumin into the LM. The variable of curve width, alpha, representing albumin transit time through the perfusion bed was used as the indicator of coronary flow using MCE. Ratios of hyperemic to baseline flow velocity were compared with ratios of alpha obtained with an on line software package. Compression of incoming radiofrequency (RF) signals was set to linear mode to avoid effects of logarithmic compression. All patients had angiographically insignificant coronary disease (range of Doppler CFR 1.9-4.2).

The ratio of coronary flow velocities exhibited a logarithmic relation to the ratios of alpha defined by the following equation (Vm/Vb = ratio of hyperemic coronary flow to baseline; Am/Ab = ratio of alpha):

$$\text{Log } Vm/Vb = 0.48\ Am/Ab + 0.22 \quad (r = 0.97)$$

The strong correlation of alpha with Doppler estimates of CFR demonstrates that MCE using LM bolus injections of sonicated albumin follows indicator dilution principles when RF compression is linear. We conclude that on line MCE can provide a less invasive and quantitative measure of CFR in the cardiac catheterization laboratory.

Tuesday, March 5, 1991
10:30AM–12:00NOON, Room 360, West Concourse
Assessment of Coronary Artery Disease by Intravascular Ultrasound II

10:30

ERRORS IN DOPPLER CATHETER ABSOLUTE VELOCITY MEASUREMENTS: THE EFFECT OF INHOMOGENEOUS BEAM POWER DISTRIBUTION

Scott J. Denardo, Paul G. Yock, Victor K. Hargrave, Peter J. Fitzgerald, James P. Srebro, Thomas A. Ports, Lawrence Talbot. University of California, San Francisco, CA

Measurements of mean coronary blood flow velocity (μ_1) by Doppler ultrasound catheters have significant systematic errors that have not been completely characterized. We hypothesized that inhomogeneities in the catheter ultrasound beam may have a major impact on the accuracy of mean velocity determinations.

To test the effect of beam profile, we constructed a scaled-up model of coronary flow using an optically clear cylindrical test section through which accurate laser-Doppler velocimeter (LDV) measurements could be performed at multiple positions. The precise beam profile of a custom-designed Doppler ultrasound catheter (DUS)/guidewire with annular transducer was measured utilizing miniature hydrophones. The three-dimensional beam power distribution function was used to correct the LDV measurements and generate a predicted value of the experimental DUS mean velocity. A variety of flow conditions at Reynolds numbers representing the range of physiologic coronary flow was studied. The regression line describing the correlation of the uncorrected mean velocity with the experimental DUS mean velocity deviated substantially from the line of equality:

$$\mu_1(\text{DUS}) = 1.25\mu_1(\text{LDV}) - 1.32 \text{ cm/sec} \quad (r = 0.97).$$

With the beam profile correction, a significantly more accurate measurement of mean velocity was obtained:

$$\mu_1(\text{DUS}) = 1.09\mu_1(\text{LDV}) - 0.66 \text{ cm/sec} \quad (r = 0.98;\ p < 0.0001).$$

Conclusions: Inhomogeneity in beam profile causes a significant error in measurement of absolute mean velocities by Doppler catheters, which results in inaccurate determinations of true coronary flow. Measurements of peak velocity and coronary flow reserve by the ratio of mean velocities will not be affected by this error.

11:00

DISTINCTION BETWEEN SOFT PLAQUE AND THROMBUS BY INTRAVASCULAR ULTRASOUND TISSUE CHARACTERIZATION.

Peter J. Fitzgerald, Andrew J. Connolly, Ron D. Watkins, Victor K. Hargrave, Paul G. Yock. University of California, San Francisco, California.

Intravascular ultrasound (IVU) provides definition of the boundaries of plaque and can discriminate fibrocalcific from soft plaque. Distinguishing soft plaque from thrombus, however, may be difficult based on imaging alone. Accordingly, we tested the ability of radio-frequency (RF) backscatter tissue characterization analysis to enhance plaque/thrombus discrimination in an in-vitro setting. Studies were performed on 16 freshly excised, diseased human coronary and femoral arterial segments and 6 freshly formed clots from human blood. Each clot was analyzed at multiple locations resulting in a total of 20 samples. Tissue and clot specimens were suspended in a water bath within the focal zone of a 30 MHz transducer oriented 90 degrees to the region of interest (ROI). Axial resolution of the RF impulse response of the transducer was 80 µm. Sequential RF signals from each ROI were digitized at 250 MHz and stored on computer disc for analysis. For each ROI, the average RF envelope probability distribution function (PDF) was determined and the MSR (mean/standard deviation) computed. Histologic analysis demonstrated that 13/16 vessel ROIs contained soft plaque (mixture of fibrous and fibrofatty components) involving only the intimal layer with an intact internal elastic lamina. Analysis of each thrombi showed a characteristic collection of red cells interlaced with fibrin strands. The MSR derived from RF analysis showed distinct changes in the PDF morphology for soft plaque as compared to thrombus.

Soft Plaque	(N=13)	2.27 ± .33	(P < .001)
Thrombus	(N=20)	1.95 ± .16	

Conclusion: These preliminary in-vitro results suggest that tissue characterization methods have the potential for discriminating soft plaque from thrombus.